Ministry of Economic Development
Manatū Ōhanga
Intellectual Property Office of New Zealand

PCT/NZ03/00235

CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 21 October 2002 with an application for Letters Patent number 522157 made by Rocktec Limited.

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Dated 5 November 2003.

Neville Harris
Commissioner of Patents, Trade Marks and Designs

COMMISSIONER OF PATENTS, TRADEMARKS & DESIGNS
NEW ZEALAND

330 High Street, Lower Hutt and 17 Toop Street, Seaview
PO Box 30687, Lower Hutt, New Zealand or DX SX 11129, Wellington
Phone: +64 4 560 1600, Fax: +64 4 560 1691, www.iponz.govt.nz

PATENTS FORM NO. 4

Appln Fee: $50.00

James & Wells ref: 121249/31

PATENTS ACT 1953

PROVISIONAL SPECIFICATION

AN IMPROVED DEVICE

We, Rocktec Limited, a New Zealand company of Mangawhero Road, Matamata, New Zealand

do hereby declare this invention to be described in the following statement:

AN IMPROVED DEVICE

TECHNICAL FIELD

This invention relates to an improved device.

In particular it relates to an improvement to a device that is used for the breaking or weakening of material.

BACKGROUND ART

It is common practice in the construction or demolition industry to use hydraulic hammers in order to break up concrete, rock, hard ground, asphalt or unwanted structures for removal or further construction.

A large proportion of the material to be broken up consists of either concrete or asphalt. These materials have very different characteristic and therefore require different type of machinery or tool bits to break them up. Concrete is a very brittle material and can therefore be smashed by impaction. Asphalt is a ductile or 'plastic' material that tends to absorb a lot of the energy applied through impaction. Accordingly, asphalt or similar materials need to be fractured. A finer blade will effectively slice, puncture or crack the material, therefore allowing demolition to be completed by cutting rather than hammering.

Where asphalt is laid over concrete, as with many north American roadways, two types of hammer configurations can be required to complete the job, depending on the thickness of the asphalt. This double layer can therefore mean the need for more than one demolition machine on a job, doubling the cost of demolition and creating down time for the concrete breaker while the asphalt breaker gets started and exposes the concrete.

Furthermore, ground that has been frozen by permafrost, for example in central Europe, can also have a more ductile or plastic nature. A blunt ended hammer will apply a force that will often be absorbed by the ground, resulting in either a punched hole and no fracture, or the ground will just bounce back due to the springiness of the peat beneath it. A finer blade tip is required to fracture the material. Again, either further machines are required, or the industry is delayed over the winter months. Additionally, the colder the conditions, the greater the likelihood of damage to the machinery due to temperature gradients across the hammer leading to thermal shock and resultant fracture.

The breaking up of ground that is frozen due to permafrost with current technology has proved to be virtually impossible and as such construction is limited to the warmer months that in some cases can be as short as ten to twelve weeks.

It would be an advantage to extend that construction time, even by a few weeks either side of the warmer months.

A typical drop hammer, being one type of demolition hammer device, consists of a heavy plug or column that is raised and then released. Gravity propels the plug or column towards the ground and the type of impact with the ground is determined by the shape of the face of the plug or column that connects with the ground.

It would be an advantage to be able to easily vary the nature of fracture beneath the drop hammer so as to enable a single machine to operate in various conditions with different types of materials. However, any ability to vary the nature of fracture must be combined with the usual durability and overall strength required by the industry. It would be a limitation to produce a system that could be varied, but required high maintenance or a large period of downtime to implement.

All references, including any patents or patent applications cited in this specification

are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a propelled rod with at least two end conditions

characterised in that

the position of the end conditions can be reversed when required.

According to another aspect of the present invention there is provided a drop hammer

assembly including a hammer configured with at least two end conditions

characterised in that

the position of the end conditions can be reversed when required.

The term "propelled rod" in accordance with the present invention should be understood to mean an elongated shaft that is propelled toward a material in order to impart an impact.

The propulsion of such a shaft can be provided by gravity or by an accelerating means, or by a combination of the two.

In preferred embodiments, the propelled rod is an elongated shaft of either cylindrical or multi-faceted proportions that is able to be lifted in a substantially vertical direction prior to being released.

In some embodiments, gravity is used to provide the propulsion required to impart a force to the ground beneath the shaft.

In other embodiments, the propelled rod is also able to function in a direction away from the vertical, allowing it to break material that is above ground level. The introduction of an accelerating means allows the assembly to function without such a large reliance on gravity to propel the shaft toward the ground or material to be broken.

In preferred embodiments the shaft is a hammer for use in a drop hammer assembly or device, and for ease of reference the shaft is hereafter referred to as a hammer, although this should not be seen to be limiting in any way. The hammer is housed in a hammer housing, the internal workings of which enables the hammer to be lifted and released to impart force to the ground below the hammer.

It should be appreciated that it is an advantage of the present invention that the propelled rod is directly impacting the material desired to be broken, it is not striking an intermediate tool. This means that the system as a whole is simple and there are less moving parts to wear and fail over time. Each face can be reinforced, or built up after wear, and the hammers themselves can be replaced.

In some embodiments, a connecting means is provided between the hammer housing and the upper end of the hammer.

In preferred embodiments, the connecting means is able to undergo elastic deformation, thereby storing potential energy when being held in a tensioned state. When the hammer is at the peak of its vertical movement, the connecting means is extended to a tensioned position. When the hammer is released, the potential energy stored in the connecting means in the form of tension is released and the hammer is accelerated toward the ground with greater energy than that provided by gravity alone.

US Patent No. 4,844,661 describes a drop hammer that utilises a reversing electromagnet to provide both lift and repulsion to the hammer. The electromagnet is engaged to raise the drop hammer to the top of its radius of movement. The electromagnet is then reversed and both gravity and the repulsion of the reversed electromagnet combine to accelerate the drop hammer to the ground, increasing the force with which it hits the ground.

It is a limitation however of such a system that the type of ground or material to be broken by the hammer is determined by the shape of the hammer and this cannot be easily varied. For the device to work with brittle materials when it is configured to work with ductile materials, a considerable amount of down time would be needed to fit a new hammer.

US Patent No. 5,248,001 describes a drop hammer that utilises a spring or springs within a drop hammer housing that are fully compressed when the hammer is at maximum vertical height before dropping. As the springs expand, the hammer is accelerated toward the ground again increasing the force at which the face of the hammer hits the region underneath.

It is a disadvantage of this system also that the type of material to be broken by the hammer is set by the shape of the end of the hammer and this cannot easily be varied. Accordingly, the hammer can only be used to break one type of material, be it brittle or ductile or the like, and a second machine would be needed on site for other materials.

The term 'condition' in accordance with the present invention should be understood to mean the shape of the surface of each end of the propelled rod, or the face. This shape could include a substantially flat face, a blade, a convex or concave cup or a point, however, these are listed by way of example only. For ease of reference throughout the specification, the term 'face' will be used to refer to the condition of each end of the propelled rod, however, this should not be seen to be limiting in any way as a blade or point is not usually referred to has having a face, although they are intended to be included here when the term 'face' is used.

In preferred embodiments, the hammer with at least two end faces is characterised in that the end faces are of different configurations.

In further preferred embodiments, the hammer has two faces, one at either end of the hammer where one of the end faces of the hammer could be of a substantially flat, wide face in order to provide a large region of impact beneath the hammer, imparting the ability to weaken or break larger regions of brittle material.

In further preferred embodiments, the other end face on the alternate end of the

hammer could be in the form of a blade, therefore allowing ductile or plastic material to be broken up.

It should be appreciated that the tip or end of the hammer could also be configured in other ways to be suitable for other types of material or demolition jobs. The tip could, for example, be in the shape of a spike or sharp tip, instead of a blade, although this is listed by way of example only and should not be seen to be limiting.

While drop hammers configured to cope with various types of materials do exist, there does not appear to be a single drop hammer device that allows many types of materials to be broken by the same piece of machinery without significant amounts of mechanical work or down time required to achieve this.

While it should be appreciated that some drop hammer devices could have the impact face at the end of the hammer removed in order to either renew the tip or face, or to alternate between a wide and narrow impact face, the amount of stress and strain placed on any nuts or bolts in that region would be immense. The likelihood of bolts or the like shearing through failure due to high impact loads would be greatly increased. This can be disadvantageous when there are deadline pressures or limited access to repair resources.

Another problem inherent with changeable tips is that a certain degree of expertise is required in order to ensure the new tip is correctly mounted in its seat and tension bolts having the appropriatwe tools to do so.. Any misalignment of the new tip with the seat will result in rapid damage of the tip and loss of all precision of both the tip and seat mountings.

With regard to the present invention it should be appreciated that the nature of the material will determine the configuration of the hammer face. It is therefore envisaged that should a machine be needed for a job with several types of material,

more that one double ended hammer could be supplied, as the hammer could be ejected and a whole new hammer put into the housing which has different faces.

The faces and tips of both the flat and bladed ends of the hammer could also be reinforced with material, or rebuilt due to wear down.

According to another aspect of the present invention there is provided a method of reversing the orientation of the hammer,

characterised in that

the hammer can be withdrawn, reversed and reinserted into its operating position.

According to a further aspect of the present invention there is provided a method of reversing the orientation of the hammer within the hammer housing, wherein the hammer has at least two end faces,

characterised in that

the hammer can be withdrawn from the hammer housing, the position of the end faces reversed and the hammer reinserted into its operation position.

It is an advantage of the present invention that the ability to remove the hammer from the hammer housing, reverse the direction of the hammer and reinsert it into the housing is a simple matter that could be undertaken by one person.

It should be appreciated that hammer will have certain protrusions that enable it to be lifted within the hammer housing to its peak vertical position. In order to reverse the orientation of the hammer, thereby exposing the alternate end of the hammer, those protrusions would need to be matched on the alternate side also.

In preferred embodiments, the additional protrusions would be positioned to the left or right of the original protrusion, on the same face.

However, it should be appreciated that the protrusions could be positioned on the alternate face, depending on the shape of the hammer housing, and the way in which the blade is reinserted into the housing on reversal.

Should the hammer be connected to a tensioned cable, that cable would need to be disconnected and then reconnected after re-orientation of the hammer, therefore also meaning that any connecting means would need to be matched on the alternate side of the hammer.

It should also be appreciated that as the hammer has varying end configurations, the means for raising the hammer would need to be positioned to any side of the hammer, not positioned at the end of it.

In preferred embodiments, the means for raising the hammer to its peak vertical position would be by a side chain and dog arrangement. The chain rotates around two sprockets positioned alongside the hammer. The chain has a dog that abuts a protrusion positioned on the side of the hammer. As the chain is rotated, the hammer will lift as the protrusion affixed to the chain rises with the rising of the dog. As the hammer reaches its maximum vertical height, the dog rotates around the chain sprocket and the hammer is released.

In further preferred embodiments, once the dog rotates around the sprocket and the hammer begins to fall, the rotation of the chain will mean the dog will come up against and abut the protrusion on the alternate side of the hammer, which is there in order to allow the direction of the hammer to be reversed. The dog will therefore impart a downward force to the hammer, increasing the acceleration of the hammer over a short distance due to the speed of rotation of the chain. Once the hammer picks up sufficient speed, gravity will increase the rate of decent of the hammer and the dog will no longer abut the protrusion.

In preferred embodiments, the hammer housing will have a number of posts or uprights positioned near the exit point of the hammer from the housing that are cushioned. The cushioning would lessen the impact of the protrusion of the side hammer housing and potentially lengthen the lifetime of the hammer itself. The cushioning could be replaced over time as it wore out.

It should be appreciated that the hammer would be positioned at an appropriate height above the material or ground to be broken and as such, that ground would receive the majority of the impact force and not the protrusion or cushioning. Accordingly, the cushioning will wear out, but at any cushioning system would be designed for easy removal and replacement with little down time.

The advantage of having a drop hammer device with two differing faces that can be reversed with ease is that the same piece of equipment can be used on sites where varying types of material are required to be broken. This reduces the cost of a job requiring both brittle concrete and ductile asphalt or the like to be broken. It also enables the operator to switch easily between both types of impacting at short notice.

The ability of a drop hammer device to be applicable in varying situations is also an advantage in that the drop hammer device described herein does not return the impact vibration back to the excavator and therefore the operator. As the hammer is not physically connected to the housing, unless by the tensioned means alone, the impact of the hammer does not impart any vibration to the housing. Accordingly, the driver is not exposed to high levels of vibration and therefore the job becomes more tolerable over extended periods of time. Additionally, the driver does not welcome a break when differing types of material are revealed and needed to be broken and a new machine required. Instead, the comfort to the operator is high, and the damage to the excavator itself from extensive vibration is non-existent.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic illustration of a preferred embodiment of the present invention; a

Figure 2 is a diagrammatic representation of a preferred embodiment of the present invention showing the side on view of the drop hammer with lifting means, and

Figure 3 is a close-up diagrammatic representation of a side view of the drop hammer showing the cushioning means and rotating chain.

BEST MODES FOR CARRYING OUT THE INVENTION

With reference to figure 1, there is illustrated a drop hammer (1), encased within a hammer housing (2) which is attached to a hydraulic excavator generally indicated by arrow 3.

With respect to figure 2 there is shown a close-up of a drop hammer device generally indicated by arrow 4. The drop hammer device (4) consists of a hammer (1) with a dull end (5) and a sharp end (6), a protrusion (7), a raising mechanism generally indicated by arrow 8, the raising mechanism in the form of a rotating chain (9), with two cogs (10 a and b), a hydraulic activating means (11) and a hammer housing (2).

With respect to figure 3 there is shown a side view of the hammer (1) with the rotating chain (9), the two end sprockets (10 a and b) which the chain (9) rotates around, a dog (12) which engages the protrusion (7) on the hammer (1).

Also shown if figure 3 is the cushioning means (13) that the hammer (1) can rest against when situated in its lowest vertical position.

When the drop hammer (1) is operating, the rotating chain (8) with dog (12) rotates.

The dog (12) abuts the protrusion (7) situated on the side of the hammer perpendicular to the rotating chain (9).

As the chain (9) rotates, the dog (12) rises, lifting the protrusion (7) which in turn raises the hammer (1).

When the protrusion (7) rises to a point level with the upper sprocket (10a), the dog (12) rotates over the top of the upper sprocket (10a) and releases the protrusion (7), allowing the hammer to fall.

When the hammer (1) has completed its fall, the dog (12) positioned on the rotating chain (9) will then abut the protrusion (7) and repeat the vertical lift.

Also shown in figure 3 is the cushioning means (13) that the hammer (1) can rest against when situated in its lowest vertical position. If the hammer (1) is not in use, the protrusion (7) will rest against the cushioning means (13) so that the hammer can either be moved or transported without banging against the hammer housing, or damaging the rotating chain or the like.

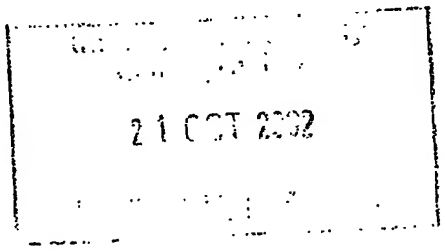
Not shown is the tensioned means that can be attached to a point just below the upper end of the drop hammer (1). As the hammer (1) rises to its upper vertical limit, the tensioned means is stretched. When the dog (12) is rotated and the protrusion (7) released, the hammer (1) is pulled in a downward direction, accelerating the hammer (1) into the ground due to the release of the tensioned means.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

ROCKTEC LIMITED

by its Attorneys

JAMES & WELLS



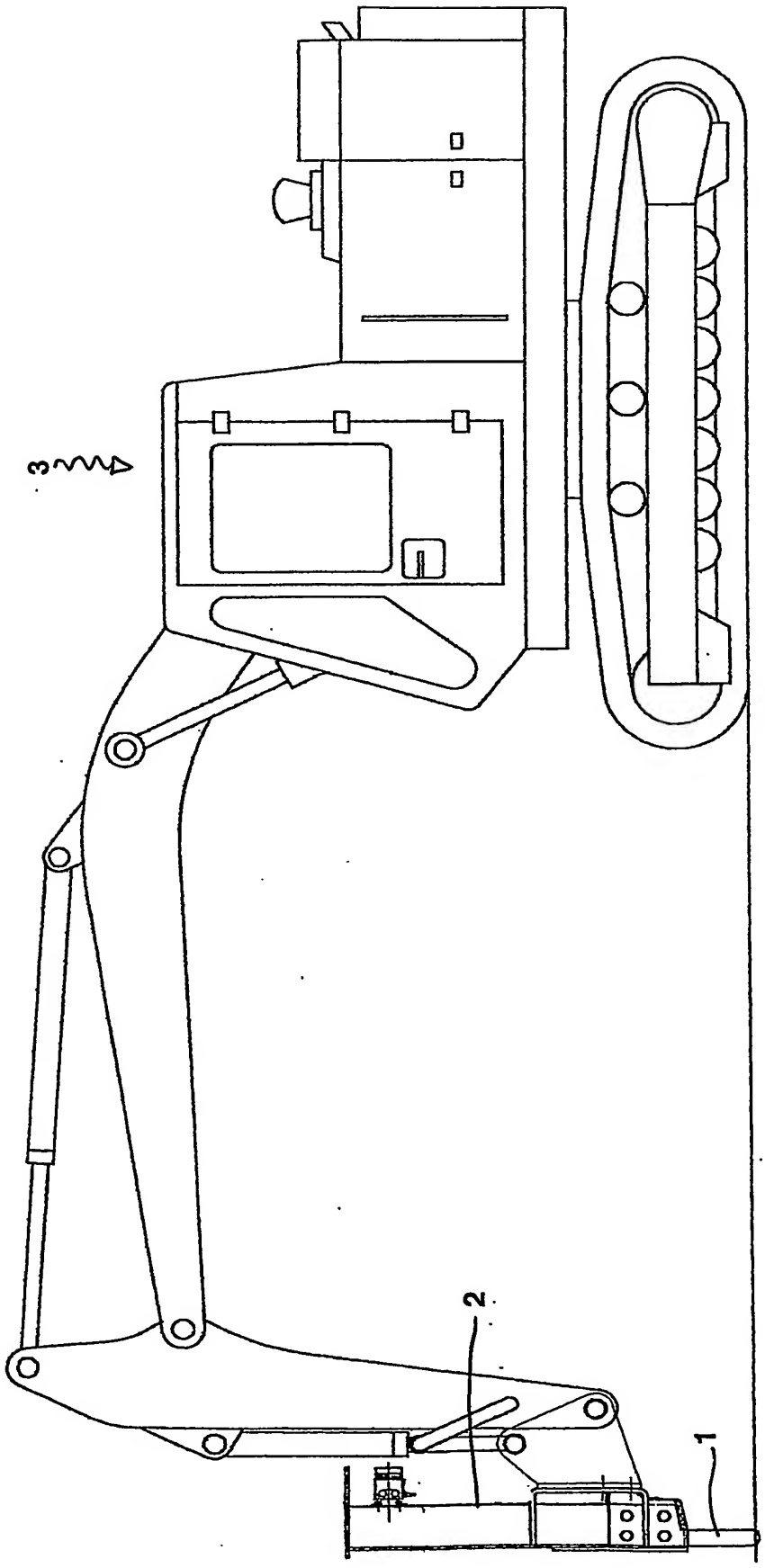
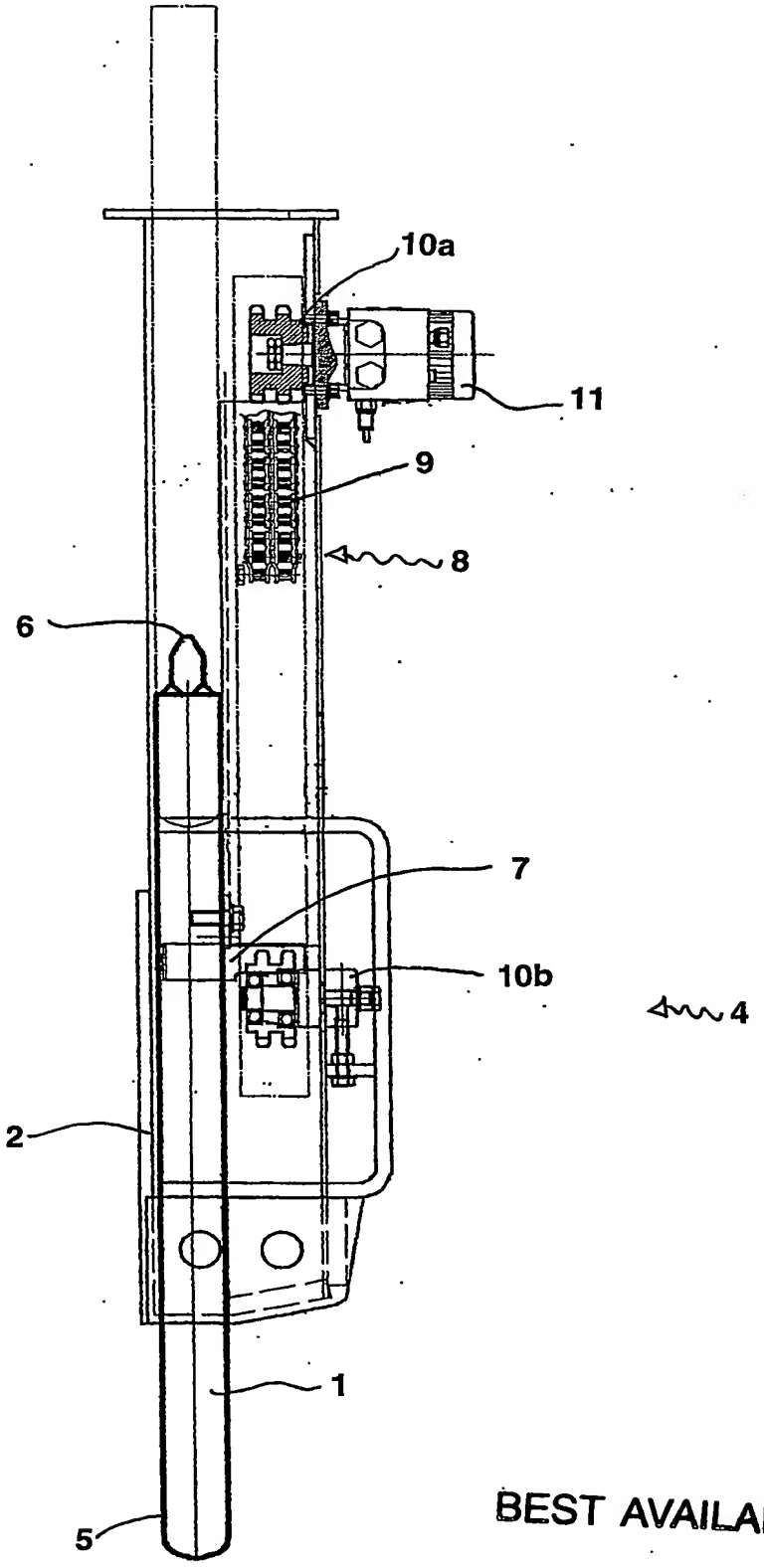


FIGURE 1

FIGURE 2



BEST AVAILABLE COPY

FIGURE 3